SCIENCE

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CONTENTS

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ARE WE AN INVENTIVE PEOPLE IN THE FIELD OF EDUCATION?[1]

EVERY invention, I suppose, is made up of individual and social elements, and combines them in a way different from that of every other invention. There is no more interesting department of literary criticism, or esthetic criticism generally, than that which seeks to trace out the respective contributions of the race and the individual in any work of art. This is illustrated in a recent discussion of the distinction between the folk-epic and the art-epic,[2] the characteristic difference, for example, between the 'Iliad' and 'Paradise Lost.' Some Homer, in the one instance, whatever his name, gave the final form to a poetic tale that must have been shaping itself in the traditions of his people for many generations. In the other instance, in which we may distinguish the poem from the contemporary materials out of which it was constructed, the work of the poet looms large, and the work of the people back of him is obscured by his personal fame. Yet, when we analyze even Milton's art, with all of its manifestation of a fearless and independent personality, we find it related in the subtlest ways with the literary tradition of his time.

So it is in the history of mechanical invention. We have seen recently a running discussion of the origin of the electric trol-

[1] An address before the chapter of Phi Beta Kappa, at Vassar College, June 10, 1907.

[2] By Professor C. B. Bradley, *The University of California Chronicle*, June, 1906.

ley car. This very modern invention is commonly referred for its beginnings to the electric railway first operated at Richmond, Virginia, in 1888. But it appears that that undertaking had a forerunner, and that forerunner in its turn had a prototype, and the successful American inventor is found to be only the topmost figure of a human pyramid, made up of no one knows how many experimenters in this particular field. The Patent Office has difficulty enough in distinguishing each new invention from its patented predecessors. But when we go aside from the series of formal patents and look to the succession and mingling of motives and ideas, the tangle passes our ability to unravel. We can only see how inextricably the stroke of individual initiative is enmeshed in the movements of a whole people, and that very complication we find it a delight to contemplate.

Now, this social character of all invention appears in a peculiarly vital way in any original work in education. For education in a special sense not only springs from the people, but in turn creates the people from which it springs. Education is its own father. An over-emphasis on individuality in education would quickly carry us away from the line of direct succession. It would give us isolation and sterility instead of recreating the spiritual life of the race.

One can not add too quickly that in the nature of things the danger of a dead lack of individuality is usually a more threatening danger. But let us at once get down to our examples. To begin with, we may take the kindergarten. There has hardly been a more distinct and conspicuous invention in the whole history of schools. It is a thoroughly conscious and modern work of art, in which the personal agency of the inventor comes to the fore. That is the very weakness of the invention. To this day it has not been assimilated. In our educational concert it is a voice that sweetly sings in tune but that refuses to blend with other voices of the chorus. There may be different explanations of this lack of accord. It may be that the individual note is permanently at variance with anything that can be made universal. Or it may be that the kindergarten is merely in advance of the age and will bring the rest of education round into adjustment with itself. It seems pretty clear that both explanations are in part correct. The kindergarten, with certain other forces that have worked toward similar ends, has brought our elementary education a long way toward its type of faith and practise. Yet the emphasis on what is distinctively Froebelian still keeps it a thing apart, and seems likely to set a permanent limit to its ascendency.

It will appear from this reference to the work of Froebel that we are not now concerned simply or chiefly with those inventions which bear the sharp stamp of one man's individuality. It is a minor consideration that the invention should be known at all as the work of a single inventor. Some of the most marked of immediate successes and ultimate failures have had that distinctive imprint. Such, for example, was the monitorial system, in the forms given to it by Joseph Lancaster and Doctor Bell. Such a system may have a large usefulness of its own in the course of educational progress, but it is as scaffolding rather than as part of the permanent structure. Its very insistence upon that which is one man's makes it less fit to serve the great needs of Everyman.

So in varying degrees the educational inventions of the ages combine the distinct contribution of this or that inventor with the broad tendencies of an inventive

people. What are some of the other inventions which Europe has contributed to educational history? I mention only a few of them and with little thought for sequence of any sort. There is the educational system of the Jesuits, particularly in its seventeenth and eighteenth century form. There is the English university, made up of federated colleges. There is the seminar, which has been such an instrument in the making of German university instruction. There are two recent contributions of the Swedish people, the Sloyd system of hand-work and the Ling system of educational gymnastics. Let us add the seminary for teachers, the school garden, the Hilfsschule or school for backward children, the system of higher institutions for commercial education, the Gouin method and various other successful methods in the teaching of modern languages, the English system of university extension. And doubtless many others will occur to you. When we come to think over the list, it appears that much has been accomplished; and that European education has not only been greatly widened since the Middle Ages, to reach a manifold larger constituency, but has also been improved to a wonderful degree by the progress of educational invention.

When we would institute a comparison between European and American contributions to such improvement, it is well that we consider first the wider range of invention. The world at large gives to the Americans the credit of being a highly inventive people as regards mechanical devices. The attention of our people was early turned in this direction. Certain conspicuous successes fired the national imagination, and the stress of economic need drove us to the same end. The Patent Office became a center of national pride. To take out a patent or buy the right to sell a patented article or at least to buy something with the magic patent label attached thereto, became a well-nigh universal ambition. And in sober truth our record in the making of useful inventions is really wonderful. At first thought and without an effort you can recall the lightning rod, the steamboat, the cotton gin, the whole series of reaping machines down to the latest combination harvester, the sewing machine, the telegraph, the telephone, the arc and the incandescent electric light, the phonograph, and twenty other things that are now counted among the necessaries of modern life. It is a dazzling list, and may well make us forget the things we have not ourselves invented, but have borrowed from other lands. On second thought, however, we recall those notable creations, the steam engine, the balloon, the power loom, the locomotive engine, the daguerreotype—first-fruit of modern photography—the spectroscope, wireless telegraphy, and many others that the wit of Europe has devised. However much we may lead in the number and variety of our cunning contrivances, there is enough for which we are indebted to other lands to check our conceit and assure us that we have competitors.

On the whole, however, in the domain of mechanism we are undoubtedly in the lead. The fact that the number of patents issued annually in the United States is now only a little less than the whole number issued in all of the rest of the civilized world is not without significance. But when we turn to creative literature and the other arts the case is changed. Here, on the whole, the leadership rests with Europe. We have done good work in this field and are rapidly doing better, but not yet with that confident leadership which we display in mechanical invention. Many of the best short stories are ours. We have a score and more of writers of creditable verse—and even Europe does not seem

to be over-productive of great poems in these days. We are producing some virile sculpture that is not merely imitative, and our painters can now command the respect and admiration of the world. The superiority of our illustration-art is recognized. We are erecting many good buildings and are producing some good music. But after all, the preponderance of inventive excellence in these departments is still conceded to Europe. Our architects study at the Beaux Arts, our musicians at Leipsic and Berlin, and our young painters are known to the world when they have exhibited at the Paris Salon.

How, then, does it stand with us in the field of education? I think any one who reads in the German pedagogical literature of our day has now and then a sense of hopelessness of any educational originality. The range of its suggestion is in fact astounding. The new plan and conception of educational procedure which is just dawning above his horizon is very likely to appear in some German pamphlet or even in some 'Handbuch der Pädagogik' as a familiar notion, the boundaries of which have been well marked out and its values weighed in the balance. So any one familiar with the stream of educational influence which has long been crossing the Atlantic in our direction will proceed with caution in naming our American contributions to educational invention. Yet it will be admitted that pedagogic discussion in Germany and in other countries of Europe often outruns by far the practical embodiment of such ideas in working institutions, and even the great reach of German educational doctrine still leaves some things to the educational makers of other lands.

The Europeans themselves are generous in giving us credit for the origination of a variety of educational contrivance. Among the particulars in this bill of credit have been mentioned the American school of library practise, the kitchen garden, the high school laboratory for instruction in natural science, coeducation in secondary schools and colleges, the combination school of the Pratt and the Drexel Institute type. It is difficult for us to form a list of our own. We are too close to the facts to be sensible of their distinguishing characters, and besides we know that Europe has many surprises that might trip us if we claimed too much. But at a venture I would suggest the following as among our original contributions to education, making no claim, however, that the list is all-inclusive or even includes all of the best that we have done.

First, the non-sectarian elementary school for all classes of the community, answering to our democratic social organization and our religious liberty.

Secondly, the American high school, serving at once as a continuation of the elementary school and an introduction to the higher education, with courses meeting a variety of tastes and needs.

Thirdly, the American university, with its combination of instruction and research, of cultural and technological courses, and with liberal and professional departments often dovetailing into each other. To this might be added that notable invention, that new development of personal efficiency, the American university president.

To these institutions, at the core and center of our educational system, we might easily add a number of minor features of that system, no one of them insignificant in itself. The summer school may be mentioned, with its home-study development, as in the Chautauqua type; the text-book in its better forms, and the better type of instruction based on the use of the book; the college gymnasium, for physical education; the consolidated country school, with provision for the transportation of pupils;

the organization of public libraries and museums in close connection with the work of public schools. How many others there are that come crowding on the attention! One is tempted to mention Helen Keller as one of our most admirable educational achievements. The story of her training into normal and honored womanhood is one of the most stimulating passages in our educational history. And Tuskegee is another. Then, too, we recall our schools for the training of nurses, which in a very few years have come to enroll twenty thousand students annually. I may speak of another example, which falls within my own sphere of labor, for as a new invention it was the work of my honored predecessors. I refer to that special type of industrial training which is connected with the introduction of domestic reindeer into Alaska.

In that northern country the necessity of making some better provision by which the natives might clothe and feed themselves, was the mother of this combined industrial and educational invention. Reindeer were imported from Siberia. Teachers were brought from Lapland. And the Eskimo were set to the lesson of caring for the deer, of breaking them to the sled, of using them in profitable service of the incoming white population; and so of adjusting their lives to a new industry, by which they might maintain themselves in the face of new conditions which threatened their very existence. Here was a truly constructive treatment of a most difficult racial problem. A new industry was fitted to new conditions and a new education was based on that new industry. While the arrangement has not yet shown what its full development may be, it has become well established in these more than fifteen years, and already it has made its place and proved its usefulness.

But we can not fairly estimate the measure of our inventiveness unless we turn to the other side, and see what are some of the defects in our system which we have left uncorrected. These are the points where our educational invention has thus far failed to do its work, and they are neither few nor unimportant. I think it will appear that all along the line, from the bottom to the top, our educational system, the object of so great national pride, is still marked by serious inadequacies.

We have not yet made any great improvement in the nurture of children at home, up to the kindergarten age or the age of the primary school.

We have not yet brought the kindergarten into full adjustment to our educational system nor devised any adequate substitute for the kindergarten.

We have found ways of keeping one half of our pupils in school up to the sixth or seventh grade but we have not found ways of keeping all of them to the end of the elementary course.

We have not yet organized nature studies in the schools into any well-knit adjustment to general education.

We have not yet carried our instruction in drawing up into fully effective training for the fine arts, in secondary and higher schools.

We have not yet brought our religious education, as carried on in Sunday-schools, into any effective parallelism with the secular instruction of the public schools.

We have not yet brought our normal schools into satisfactory adjustment with our cherished sequence of schools from the kindergarten to the university.

We have not yet wrought out a satisfactory arrangement for the training of teachers for secondary and higher schools.

We have hardly as yet established a permanent teaching profession.

We have not devised adequate means of

giving needed cultivation, esthetic, intellectual and moral, to the individuals who make up the student body of our mammoth universities.

We have yet to work our way through the gaseous, centrifugal atomism of our college elective courses into an organized and unified national culture.

We have not yet achieved a national standard in our academic and professional education, nor have we organized any effective and economical cooperation among our schools of graduate instruction and research.

We have not yet devised ways by which public education can be definitely and adequately focused upon the improvement of our national morality.

The list, again, is by no means complete, but it is surely long enough for the purposes of this discussion.

I do not take a pessimistic view of the situation in which these defects appear. In every one of the particulars enumerated, serious efforts toward improvement are making even now, and we can not doubt that full success will ultimately be achieved. There have been devoted teachers who have labored long for such improvement, and in some instances their accomplishments have been great and beneficent. But that our triumphs in these particulars have been local and exceptional rather than permanent and national, will be generally agreed, and it is well that we look this unwelcome fact in the face.

We may now attempt a direct answer to the question which was asked at the beginning. Are we an inventive people in the field of education? We are unmistakably, an inventive people in this field. It can hardly be doubted by any one who looks upon the exuberant Americanism of our elementary schools, the great expansion and continued readjustment of our secondary education, the growth of our universities and of university influence in ways that catch so exactly our national characteristics and turn them to academic ends; nor can it be doubted by any one who watches from year to year the spread of our education into new fields by new and untried processes. We are inventive in our education, but it is not yet clear that we are preeminent in this regard, and our educational invention still lags far behind our invention in the domain of mechanism.

We may be easily misled by the flattering reports of foreign visitors. With all of their frankness in pointing out our defects their general criticism of our schools is for the most part extremely favorable. But we must not forget that education with us is in the sweep of a strong tide of popular sentiment. Every invention that we have put forth is carried forward by that current and finds opportunity to do, in full swing, its destined work. Not that individual inventors do their work unhampered and with no discouraging delays. That could never be. But by contrast with Europe, the way of educational improvement here is direct and clear. We cannot yet fairly judge what our education would accomplish under greater difficulties and in the face of closer competition. It is safest for us to take the moderate view, and hold that our educational successes thus far, great and glorious as they are, are only great enough to confirm our hope and confidence, and not yet sufficiently great to insure to us the ultimate leadership.

Our inventiveness in this field is less conspicuous, as has been said, our education shows less of readiness to seize obscure suggestions and carry them through to unlooked-for triumphs of efficiency, than that which we have long disclosed in our Patent Office reports. Yet this field is at least as interesting as the other. It makes intense appeal to widely differing minds, and

public attention is often drawn to new educational projects in a measure that is truly astonishing. What is needed is that that public interest should be more sustained and more clearly manifest; that the inventor in education should have the unfailing stimulus which has goaded our mechanical inventors to their most strenuous endeavors. And on the part of the inventor himself there is need of all the patience and resource of the designer of new mechanism; and of other qualities, subtler far than these, which it may be worth our while to consider at this point.

The inventor in education does not bring before the people a new object which they are to look upon and admire and use. The people are the very stuff of his invention, public sentiment is his atmosphere, he is an artificer of human society. Accordingly he must have, many times over, the patience of the mechanical inventor. He must be willing to merge his fame in the larger life of the invention. For if it is a real and living invention he will find that there are many collaborators, and it may take generations to bring the design to its perfection. In education it is generally true that an invention that is only of one man size is not large enough to last. Yet the work calls for zest and courage, and there is ground for individual encouragement. Social changes are accelerated in these days. The single generation has, more than ever, its chance of striking an arc of appreciable advancement; and there was never a time when one man in his one earthly life had a better chance of doing some work of noble note. I believe the spirit of educational invention can be quickened among the men of America, to meet the larger demands that are upon us. And if this language seems to spread out shield and spear in the household of Lycomedes, it is not that I am seeking Achilles at Vassar. It should be said rather that the highly educated women of America are themselves to have a most important part in this educational quickening. Indeed, it is not too much to hope that the time is at hand when our men and women will take share and share alike in this work—alike but different. And we may trust and pray that the great work that our women are already doing in every phase of social improvement may not cause the men of America to dream that their responsibility can be shifted, but may rather remind them that they must not fail in their part.

It may be well to enter here upon some brief discussion of three or four of the problems now calling for constructive leadership. In the first place, let us make note of an unfinished movement, which demands our best skill and will surely reward its exercise. It has been said that the education of the school and education by apprenticeship, after centuries in which they have gone apart, are drawing near together in these days. It seems fair to expect, in fact, that the school of the future will be the result of their union. The combination appears in many forms. Most familiar of these, up to the present time, is the school laboratory in the natural sciences. Here instruction from the book assumes a subordinate place and the pupil learns by what he does. Already, too, the method of the scientific laboratory is permeating other departments of the school. It has influenced the teaching of history and the languages, and we may even see its influence extending to the teaching of law in the professional school. But now the school and the apprentice system are drawing together in other ways. The movement is obvious in manual training and domestic education. The actual contact of the two systems in their organized forms, however, has been especially marked in the past two

years. At the Carnegie Technical Schools in Pittsburg arrangements have been entered into by which boys will take a part of their training for certain trades in the ordinary course of apprenticeship, under the control of the trades unions, and another part of their training for the same trades in the technical schools. At the University of Cincinnati the experiment is making of combining work for wages in a regular shop with the studies of an engineering course, two young men counting for one in the shop by alternating on one-week shifts, each taking his university studies in the week that he is not at the bench. The experiment is watched with the liveliest interest by both shopmen and university men and thus far it gives promise of success. In the movement toward the establishment of public trade schools, now under way in Massachusetts and Connecticut and in several other states, the relation of the apprenticeship to the school is a question of the utmost importance, both educationally and in its connection with the problems of trades unionism. From a general pedagogical standpoint the combination of the methods of the literary school with the methods of apprenticeship seems one of the most promising of present opportunities for the exercise of educational invention.

May I venture, in the second place, to speak of the present problem in the higher education of women. I will not say what I think about the subject here and now, when I am so happily indebted to your generous hospitality. I do not think you would care to have me indulge in the language of compliment. But before I came to Vassar, let us say, the question of woman's higher education in America seemed to me to lie about as follows: That, after the great advance we have made in this field, which has commanded the attention of the world and the admiration of a good part of the world, we have come to something like a standstill, and some of the most important steps have not been taken as yet. It has taken a great struggle to establish fully the higher education of woman as a simple human need. But that battle has been won. The integration of woman's education with the general scheme of education has been brought about. But the differentiation of woman's education is yet to be accomplished. Let us admit that the task of integration was by far the greater task. But does it follow that the differentiation is no task at all? Or to put it in other words: the functions of men and women in society are different in many ways. Do those differences lie wholly beyond the range of education? I am confident that they can not permanently be left outside of the range of education; but the task of bringing them under educational treatment is one of the greatest difficulty. It calls for the highest exercise of inventive skill and patience. In coeducational institutions, under a system of free election, the problem tends to solve itself by the gravitation of women toward certain courses and of men toward certain other courses, while still other courses are common ground. But this solution is only partial and unsatisfactory. Some practicable scheme of preparation for mother-work will, we can not doubt, be devised in the course of time. There will be, some day, an education for home making and for woman's leading part in the finer forms of social intercourse, which will do on the higher academic plane what was done in a more petty way, generations ago, in popular finishing schools for girls. But this, too, is only a part. There is to be, further, a serious preparation for woman's part in the economic, the industrial, and even the political world. What the all-round solution of this problem will

be, I can not tell nor even guess. But if it meets the need, it will be an educational invention of the highest order of excellence.

In the third place there is the international organization of education. Commissioner Draper has recently called attention to the tremendous number of men and women engaged in teaching throughout the world to-day. There are not far from three and one half million of them, according to his estimates. And for the most part they are engaged in what is essentially the same work, wherever they may be. The full realization of the unity of this great body of teachers, when it is attained, must have profound consequences for the peace and civilization of the world. Already we are working toward such unity in a number of definite and special ways. Many of these ways are already familiar to all: The visits of teachers and other educational leaders of one country among the schools of other peoples; systematic efforts of one people to spread a knowledge of their culture and ideals among other peoples, as exemplified in the Alliance Française; the exchange of university professors; and a variety of other procedure. If the diplomatic relations of nations have passed into an economic stage, it should be added that they are passing into an educational stage. Mr. Barrett, the chief of the Bureau of American Republics, urges, with good show of reason, that if we wish better commercial relations with the proud and sensitive peoples of South America, we must first meet them on higher ground, through an understanding and recognition of their culture and education. Already we can see signs of the emergence of world-standards in school education and university education and particularly in professional education. It is an immediate and practical need that we put our higher education into shape to deserve, and by deserving to compel, recognition, the world over, of our academic and professional degrees. All of these things call for new procedure, new devices, and new coordination of existing agencies. That is, in the language of this discussion, they call for a new exercise of educational invention in its very widest range.

Finally, the international need emphasizes the national need. Such a thing has happened repeatedly in the history of international relations. What we must do to take and keep our place, among the nations of the earth, reveals to us what we must do at home. No one in his senses, I am sure, would propose a centralization of American educational systems. But we need as never before an effective cooperation of our state educational organizations, and of our institutions of learning under more private forms of control. And when education is spoken of here, the meaning is education in its widest reach, from the elementary schools through the colleges and universities, from the most general to the most special of its developments, through the several forms of professional instruction, through organized scientific research, through our provision for libraries and museums and those movements which promise for us the making of a really national art. The organization of what may be called our national education in a manner suited to the spirit of our institutions and in forms commensurate with our standing among the nations—this is an undertaking which must tax the imagination and make demand for administrative originality such as the academic world has seldom seen. But it is a work that is to be done. And it will undoubtedly be the work of many men and women, brought together in intense cooperation, and be extended far beyond the limits of a single generation. It will be a work of national invention.

Such, as it now appears, is some small part of the work of education that lies immediately before us. It is a work that may well call for the most serious consideration of this greatly influential society, which aims to make its philosophy a guide into the larger life. The plea which has been offered amounts in sum to this: That by all means you will give encouragement and stimulus to our already awakened spirit of educational invention; for it takes no second sight to perceive that the times call for the exercise of that spirit in the highest things to which it may aspire.

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SCIENTIFIC BOOKS

Electrochemistry. By Dr. Heinrich Danneel; translated by Dr. Edmund S. Merriam. Part one. New York: John Wiley & Sons.

This is the first of a series of three volumes which Dr. Danneel proposes to write upon the subject of "Electrochemistry." In this volume the modern theories of electrochemistry, as well as their physicochemical foundations, are discussed. The second volume will contain experimental results and methods of measurement, while the third will be devoted to the technical applications of the subject.

Theoretical electrochemistry is beyond the stage at which any radical innovation in the method of treatment is possible. The author does, however, depart from the more usual procedure in discussing transport numbers after conductivity; and wisely too, we believe. We are not, however, convinced of the advantage of introducing a preliminary chapter on the history of electrochemistry in which much of the subject matter to follow is assumed to be known.

This volume, like its companion volumes in the Sammlung Göschen, contains a surprising amount of fact and information within a very small compass. Whether such condensation is always desirable in a theoretical subject, where abridgment of statement does not necessarily mean a lessening of mental effort, may be questioned. I am reminded of the Abbé Terrassou's remark about a book "that it would be shorter if it were not so short." We are convinced, however, that this very brevity coupled with its clarity will assure it a place of its own among text-books of electrochemistry. We imagine, for instance, that it would be an excellent book to furnish a mature student with a brief, though comprehensive view of the whole subject.

The translation is vigorous and clear. We were sorry to see the familiar expression "migration of the ions" supplanted by the less apt "wandering of the ions."

The physical appearance of the book is better than that of the German original.

Arthur B. Lamb

Researches in Experimental Phonetics; the Study of Speech Curves. By E. W. Scripture. Washington, D. C., published by the Carnegie Institution of Washington, November, 1906. Pp. 204.

Under this title is published the groundwork of the results of Dr. Scripture's recent work abroad, in the laboratories organized at Munich, Berlin and Zurich. Save for illustrative examples from the records, the present volume deals almost exclusively with methods; nearly all of the last fifty pages are taken up with tables, some of which appear for the first time, and should prove most helpful to other investigators along these lines. A discussion of the precise philological and psychological bearings of the results we may await in another volume.

The speech curves studied are obtained from amplified tracings on smoked paper of phonograph (cylinder) and gramophone (disc) records. Dr. Scripture has here employed mainly the disc records, the horizontal movement of the recording point giving a more accurate tracing. The workable portion of the records is practically confined to the vowels. The voiceless sounds as a rule give nothing beyond a straight line. The investigator seems to have brought his method to a high degree of technical perfection. The drawings illustrating the apparatus are unusually clear.

Simple levers have been obtained to amplify the disc records accurately to three hundred times and compound levers to one hundred and twenty-five times. The latter is considered to be capable of much improvement. We are all sadly aware that it is one thing to note a precaution, and quite another to observe it; but so far as the technical side is concerned there are probably few psychological or linguistic problems of equal difficulty that have been approached with greater care.

The first chapter contains some studies of the vibratory movement of the diaphragms, mainly through optical means. The conclusion is reached that the nodal (Chladni) vibrations play an inconsiderable part in the distortion of the wave evident in the familiar "twang."

> The diaphragm of the sound-box, however, bends so that there is more or less yielding and motion of the air behind it . . . in both gramophone and phonograph the wave is distorted in the manner just described (p. 22).

The commercial instruments vary a good deal in quality; about one in a hundred, Dr. Scripture thinks, is suitable for experimental purposes (p. 17). Chapters II., III., IV. discuss the apparatus and methods of immediate analysis. Much of this material will be familiar to one who has followed Dr. Scripture's previous work. On pp. 53–4 is described a control apparatus by which any portion of a curve may be reproduced as a gramophone record so as to afford acoustic analysis for the ear. By this means, any curve possible to sketch may be reproduced in terms of its sound.

The ordinary student of linguistics will find more difficulty in following Dr. Scripture through chapters V.–VII. Their interest must for the present be considered physical and mathematical rather than philological or psychological. They are concerned with problems of harmonic analysis, and a new method for dealing with the disturbing factor of friction in the voice-producing apparatus. The two theories of vowel production are discussed in chapter VIII. The Willis-Hermann theory of the varying intensity of the glottal puffs and the vowel tones as inharmonics to the glottal tone, is confirmed in these studies.

The Helmholtz theory of hearing is interestingly criticized in chapter IX. Simple harmonic analysis is insufficient to give the tones corresponding to the resonating fibers; the inharmonic frictional analysis alone represents the facts of audition, and this is at present possible only for song. Chapter X. describes methods for the synthesis of vowel vibrations, and chapter XI. illustrates the mathematics of vowel analysis; it is intended as a guide to research. Perhaps the main objection to the work is that the correctness of the original gramophone records has been taken too much on faith. There need be no question of the accuracy of Dr. Scripture's reproduction of these curves; but there is room for considerable doubt as to whether the gramophone records themselves are faithful representatives of the spoken sounds they are supposed to record. The mere fact that they resynthesize them into understandable speech is not sufficient. A variant of the method mentioned on page 55 might be employed, a gramophone record *a* making another gramophone record *b* directly from itself. A visual comparison of the two might give an idea of the accuracy of the reproducer of *a* and the recorder of *b*. Otherwise there would seem to be no escape from the tedious method of nonsense syllables, noting whether the errors made in the perception of gramophone speech are analogous to those for normal spoken speech. Until something of this sort is done, there is ground for some caution in the acceptance of this material as representative of actual linguistic facts.

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SCIENTIFIC JOURNALS AND ARTICLES

The American Journal of Science for August contains the following articles: "Radio-Activity of Thorium Salts," B. B. Boltwood; "Wave-lengths and Structural Relation of Certain Bands in the Spectrum of Nitrogen," E. E. Lawton; "Tertiary Peneplain of the Plateau District, and Adjacent Country, in

Arizona and New Mexico," H. H. Robinson; "Heat of Combustion of Silicon and Silicon Carbide," W. G. Mixter; "Vanadium Sulphide, Patronite, and its Mineral Associates from Minasragra, Peru," W. F. Hillebrand; "Mineralogical Notes," W. T. Schaller; "Thermoelectromotive Forces of Potassium and Sodium with Platinum and Mercury," H. C. Barker; "Reaction between Potassium Aluminium Sulphate and a Bromide-Bromate Mixture," F. A. Gooch and R. W. Osborne; "Preparation of Formamide from Ethyl-Formate and Ammonium Hydroxide," I. K. Phelps and C. D. Deming; "Lower Middle Cambrian Transition Fauna from Braintree, Mass.," H. W. Shimer.

We learn from *Nature* that after the current year the *Journal of Anatomy and Physiology* will be issued in two independent parts, one to be devoted to anatomical, histological, morphological, and embryological subjects, and the other to contain papers on subjects of physiological interest (including physiological histology and physiological chemistry). The acting editor of the anatomical part will be Professor D. J. Cunningham, with whom will be associated Sir William Turner, K.C.B., Professor A. Macalister, and Professor G. S. Huntington. The acting editor of the physiological part will be Professor E. A. Schäfer, with whom will be associated Professors F. Gotch, W. D. Halliburton, C. S. Sherrington and E. H. Starling.

SOCIETIES AND ACADEMIES

THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE

Twenty-first Meeting

The twenty-first meeting of the Society for Experimental Biology and Medicine was held at the College of Physicians and Surgeons, of Columbia University, on Wednesday evening, March 20. The president, Simon Flexner, was in the chair.

Members present—Adler, Beebe, Burton-Opitz, Carrel, Crampton, Crile, Emerson, Ewing, Field, Flexner, Gibson, Gies, Hatcher, Lee, Levene, Levin, Lusk, Mandel (J. A.), Meltzer, Murlin, Noguchi, Opie, Richards, Schwyzer, Shaffer, Torrey, Tyzzer, Wadsworth, Wallace, Wolf.

Abstracts of the Communications[1]

A Study of the Vital Conditions Determining the Distribution and Evolution of Snails in Tahiti, with Illustrations: H. E. Crampton.

It was shown that different valleys of Tahiti contain forms of the genus *Partula* that, on account of their more or less complete isolation, have come to differ in correlation with their geographical proximity or remoteness. Evidence was adduced showing that "mutations" have arisen at various recent times.

The Parathyroid Gland, with Demonstrations of the Effects of Hypodermic Injections of Parathyroid Nucleoproteid after Parathyroidectomy: S. P. Beebe.

It has been found that the symptoms of tetany following parathyroidectomy in dogs can be inhibited by the hypodermic injection of parathyroid nucleoproteid. The globulin from these glands has not been found effective. If the nucleoproteid is heated to boiling in an alkaline medium its inhibitive powers are destroyed.

Further Experimental and Clinical Observations on the Transfusion of Blood: George W. Crile.

Beneficial results were obtained after acute hemorrhage, after pathologic hemorrhage and in the treatment of shock and illuminating gas poisoning. Negative results were obtained in pernicious anemia, leukemia, carcinoma, strychnin poisoning and diphtheria toxemia.

A Preliminary Report on the Direct Transfusion of Blood in Animals given Excessive Doses of Diphtheria Toxins: George W. Crile and D. H. Dolley.

[1] The abstracts presented in this account of the proceedings have been greatly condensed from abstracts prepared by the authors themselves. The latter abstracts of the communications may be found in Number 4 of Volume IV of the society's proceedings, which may be obtained from the secretary.

Transfusion had no beneficial effects on dogs that received lethal doses of the toxin. Exsanguinated normal dogs, that received blood from dogs treated with excessive doses of toxin, were apparently unaffected. Blood letting, as well as blood letting followed by transfusion of physiological salt solution, had no effect upon the action of the toxin.

The Effect on the Normal Dog Heart of Expressed Tissue Juice from Hearts of Dogs Poisoned with Diphtheria Toxin: J. J. R. MACLEOD and GEORGE W. CRILE.

Expressed juice from hearts of dogs poisoned with diphtheria toxin, caused cardiac paralysis and fibrillation when perfused through hearts of normal dogs. The same result was obtained, however, with similar juice from normal hearts and with aqueous solutions of the ash obtained from such juice. The paralytic result was attributed to the influence of potassium, although the associated fibrillation requires a different explanation.

Experimental Liver Necrosis: 1. Hexon bases. HOLMES C. JACKSON and RICHARD M. PEARCE.

In the scattered focal necroses of the livers of dogs and horses the nitrogen precipitable by phosphotungstic acid, after acid hydrolysis, formed 11.3 per cent., and in the diffused necroses 30 per cent., of the total nitrogen, as against 15 per cent. for the normal. The necrotic livers that were allowed to undergo autolysis showed approximately the same percentage loss of phosphotungstic-precipitable nitrogen (hexon) as normal livers, despite the extent of the necrosis. In the focal necrosis the average was 28 per cent., in the diffuse necrosis, 21 per cent.

The Action of Nitric Acid on the Phosphorus of Nucleoproteids and Paranucleoproteids: A. B. MACALLUM.

Phosphorus is combined in caseinogen in a manner very different from that which obtains in true nucleoproteids. When treated with nitric acid (1.2 sp. gr.) at 35° C. for two weeks, no phosphate is produced. Nucleic acid and true nucleoproteins yield phosphate under such conditions. Nitric acid may therefore be employed to distinguish nucleic acids and the typical nucleoproteids from paranucleic compounds.

Does the Stomach of the Dog contain Free Hydrochloric Acid During Gastric Digestion? LAFAYETTE B. MENDEL.

Many positive results were obtained.

On the Nature of the Process of Fertilization: JACQUES LOEB.

The author's recent experiments have shown that in the purely osmotic method of producing artificial parthenogenesis, we are in reality dealing with a combination of two different agencies, one being the increase of the osmotic pressure at a comparatively low concentration of hydroxyl ions, and the other, the hydroxyl ions at a comparatively high concentration. The proof for this statement rests upon the following experimental facts.

(*a*) When the concentration of the OH is below a certain limit, namely, $10^{-6}n$, even the maximal increase of osmotic pressure fails to cause the formation of larvas from the unfertilized eggs.

(*b*) When the concentration of hydroxyl ions is high, *e. g.*, $10^{-3}n$, a very slight increase of the osmotic pressure is able to call forth the formation of larvas.

(*c*) The effects of the two agencies can be separated by first putting the eggs for from $1\frac{1}{2}$ to 2 hours into a hypertonic solution with a concentration of hydroxyl ions between 10^{-7} and $10^{-6}n$, and afterwards transferring them for some time to an isotonic solution with a concentration of hydroxyl ions of about 2 or $4 \times 10^{-3}n$. While no egg that has been exposed to the hypertonic solution will develop, many or possibly the majority of the eggs that have in addition been exposed to the hyperalkaline solution will develop into larvas, many of which are perfectly normal and rise to the surface. Eggs which develop into larvas very often (possibly always) have a membrane which, however, differs from the fatty acid membrane or the fertilization membrane in this, that it is not separated by so wide a space from the protoplasm and therefore easily escapes detection.

Comparative Chemical Composition of the Hair of Different Races: Thomas A. Rutherford and Philip B. Hawk.

After subjecting hair obtained from Indian, Negro, Japanese and Caucasian subjects, to the action of digestive juices, and also alcohol and ether, the percentage content of sulphur, nitrogen, carbon and hydrogen in the remaining keratin was found to be nearly the same for each type. The S:N ratio was practically 1:3 in each case.

The Oxidation of Sugars by Cupric Acetate-Acetic Acid Mixtures: A. P. Mathews and Hugh McGuigan.

The addition of acetic acid to cupric acetate diminishes its speed of oxidation. The amount of acid that may be necessary to check the oxidation to any given rate depends on the concentration of the acetate; the more concentrated the acetate the more acid is required.

Solutions of different concentrations of acetate and acetic acid were prepared which would just fail to oxidize levulose to a visible production of cuprous oxide after a half-minute's boiling. Similar solutions were prepared for the different sugars. Each of these solutions for any given sugar of one per cent. concentration had the same speed of oxidation. In all the solutions oxidizing any one sugar with the same speed, the decomposition tension of the cupric oxide in the solutions was a constant. For the different sugars the following data for decomposition tension were obtained in those solutions that just failed to show oxidation to a visible extent after a half-minute's boiling: Levulose, 0.583 volt; galactose, 0.562 volt; glucose, 0.558 volt; maltose, 0.532 volt; lactose, 0.519 volt.

A cupric acetate-acetic acid mixture of proper concentration will show the same selective action toward levulose that many bacteria and other living organisms manifest and will oxidize the levulose almost completely before the glucose is attacked.

Observations on the Effects of Fasting upon the Opsonic Power of the Blood to Staphylococcus aureus: Allan C. Rankin and A. A. Martin (by invitation).

Fasting perceptibly diminished the particular opsonic power studied (from 0.98 to 0.7).

The Automatism of the Respiratory Center: G. N. Stewart and F. H. Pike.

The authors described a method which seems to afford a means of temporarily eliminating all the afferent paths connected with the respiratory center. Since under these conditions the center continues to discharge itself in such a way as to maintain a long and unbroken series of regular, efficient respiratory movements, its normal activity is to be considered an example of physiological automatism, not originated, although influenced, by afferent nervous impulses.

A Series of Spontaneous Tumors in Mice: E. E. Tyzzer.

In the investigation of tumors in mice, attention has been directed, for the most part, to those which develop in the subcutaneous tissue. It is possible that *internal* tumors often occur unnoticed.

The author described tumors of the lungs, kidneys, mammary glands and lymphatic glands, and stated the effects of their inoculation into mice. Silver preparations were made by the method of Levaditti and the results given of an extended examination for spirochetes.

Concerning the Neutrality of Protoplasm: Lawrence J. Henderson (by invitation).

It is desirable, both on account of the normal production of acid during metabolism, and because of the production of acid under pathological circumstances, to study the adjustment of equilibrium in protoplasm whereby neutrality is maintained.

As a result of this investigation it appears that in the presence of both free and combined carbonic acid in measurable amount, mixtures of sodium hydroxid, phosphoric acid and carbonic acid are precisely neutral to rosolic acid, and that the amount of sodium bicarbonate in such mixtures can vary considerably without great variation in the ratio between mono-sodium phosphate and di-sodium phosphate. These results are in accord with the

theory, based upon the ionization constant of carbonic acid (3×10^{-7}) and of the ion H_2PO_4 (2×10^{-7}). Although the equilibrium in such a system at 40° C. may be somewhat different, it is evident that this equilibrium will almost perfectly protect protoplasm from variation in neutrality. The variation in hydrogen and hydroxyl ionization can hardly be more than 5×10^{-7}.

The Influence of Adrenalin upon the Venous Blood Flow: RUSSELL BURTON-OPITZ.

The blood flow in the femoral, external jugular and azygos veins was measured by means of the stromuhr previously described by the author. During the experiment, solutions of adrenalin were injected centrally to the stromuhr. The effect of the adrenalin showed itself in a retardation of the venous inflow, which appeared in from fourteen to sixteen seconds after the injection. Considering the velocity of the venous blood stream, it must be assumed that the adrenalin did not produce its characteristic effect until it had reached the arterial side of the circulatory system. The experiments tend to disprove the existence of vaso-motor nerves in the central veins and the pulmonary circuit.

The Viscosity of Laked Blood: RUSSELL BURTON-OPITZ.

It was found that the viscosity of laked blood prepared by the process of freezing is very much less than the viscosity of defibrinated blood. The specific gravity was only slightly lessened. Examples of the experimental data are appended:

Defibrinated Blood		Laked Blood	
Spec. Grav.	Viscosity	Spec. Grav.	Viscosity
1.0566	665.74	1.0563	982.35

The Determination of Ammonia and Urea in Blood: W. MCKIM MARRIOTT and C. G. L. WOLF.

Ammonia is determined by distillation in vacuo. 100 c.c. of blood are treated with 50 c.c. of saturated sodium chlorid solution, and 250 c.c. of methyl alcohol are added to the mixture. The resultant precipitate is finely granular. The residue is filtered off in a filter press, and the filtrate distilled for forty minutes, with the temperature of the water bath at 40–50° C. The receivers are charged with $n/50$ sulphuric acid, and the acid titrated with $n/50$ sodium hydroxid free from carbonate. Sodium alizarin sulphonate is used as the indicator. The results are perfectly accurate.

The residue after distillation is made acid with hydrochloric acid, evaporated and hydrolyzed with 10 grams of glacial phosphoric acid at 150° C. The ammonia formed from the urea is then distilled into $n/50$ acid. The duplicates have shown very satisfactory agreement, but it is quite certain that not all the urea which is added to a sample of blood is recovered. It is probable that the carbohydrates in the residue combine with the urea at the temperature of hydrolysis and prevent the formation of ammonia.

The Resolution of Fibrinous Exudates, with Exhibition of Specimens: EUGENE L. OPIE.

During the early stage of inflammation, a fibrinous exudate, freed from the serum by washing in salt solution, undergoes digestion when suspended in an alkaline (0.2 per cent. sodium carbonate), or in an acid, medium (0.2 per cent. acetic acid). At the end of six days, when fluid has disappeared from the pleural cavity, digestion fails to occur in an alkaline medium, but occurs with great activity in the presence of acid.

During the first stage of the inflammatory reaction, when fluid is abundant and the fibrin which is present digests in the presence of alkali, polynuclear leucocytes are very numerous in the meshes of the fibrin. In the second stage, when fluid has in great part disappeared, and the fibrin contains only one enzyme active in the presence of acid, polynuclear leucocytes have disappeared and only mononuclear cells are embedded in the fibrin.

Since the acids, which, in vitro, favor the action of the enzyme present in the second stage of the process, do not occur in the body, the possibility has suggested itself that carbon dioxide brings this enzyme into action. When carbon dioxide is passed through normal salt solution in which strips of such fibrin are suspended, digestion is very greatly hastened. The normal inhibition exerted by blood serum upon the enzyme is overcome by carbon diox-

ide; in the presence of a small quantity of blood serum, carbon dioxide causes greater enzymotic activity than in the presence of salt solution alone.

Extirpation of both Kidneys from a Cat and Transplantation of both Kidneys from another Cat, with Exhibition of Specimens: Alexis Carrel.

Both kidneys from a cat were extirpated and immediately replaced by both kidneys from another cat. After this operation the animal urinated abundantly. Urine collected during the first few days contained albumin. On the fourteenth day the cat was operated on for hernia of the small intestine through the abdominal wound. The animal died from general peritonitis one day after this second operation.

The anatomical specimen shows that the kidneys are a little enlarged. There is a slight hydronephrosis on the left side. Nevertheless, both organs appear to be in good condition.

William J. Gies,
Secretary

THE TORREY BOTANICAL CLUB

The club met on May 29, 1907, at the museum building of the New York Botanical Garden at 3:30 o'clock, with an attendance of twenty.

Dr. John Hendley Barnhart was called to the chair.

After the reading and approval of the minutes of the meeting of May 14, the following scientific program was presented:

The Linnæan and Other Early Known Species of Cratægus: Mr. W. W. Eggleston.

The earliest record found of American *Cratægi* is from the Spanish by Caspar Bauhini, in 1623. It is as follows: "*Mespilus virginiana colore rutilo. Mespilus qui colore est rutilo ut cerasa & valde dulcis,* part. I., Ind. occid."

The latter part of this quotation probably refers to Historia Medicinal, by Monardes, in 1569.

Lists of plants raised in the botanical garden at Leiden published by Herman in 1687, by Boerhaave in 1720, and by Royen in 1740; and in the *Schola Botanica,* published at Paris, in 1687; as well as Linnæus's own lists (Hort. Cliffortianus and Hort. Upsaliensis), give short references to American Cratægi; but it is to the English botanist, Plukenet, that we owe our first real knowledge of American thorns. His plates and descriptions are referred to by Linnæus, and these, with his references, are invaluable to us.

Contemporary with Plukenet was Ray, who also added somewhat to our knowledge. John Banister, of Jamestown or Williamsburg, Va., must have contributed much to Plukenet's knowledge, as he was the first English botanist to live in Virginia, and sent many seeds and specimens to England.

This Chesapeake bay region produced all of the Linnæan species, except the one that has been referred to as *C. tomentosa.* This might have been brought from farther back in the country, perhaps by the Indians, as it was one of the earliest thorns raised in England, and is not found in the coastal plain.

In Plukenet's "Phytographia," published in 1691, are five figures of American Cratægi; Plukenet says that he saw the species illustrated in his plate 46, Fig. 1 in the garden of the Hon. Charles Howard, in Surrey. This specimen Linnæus refers to *Cratægus Crus-galli.* A colored plate of it is published in the "List of Plants raised for sale by the English Gardeners about London" (Hort. Brit.), published in 1730. This is the plant labeled in the Linnæus herbarium as *C. tomentosa.* About this Miller was undoubtedly right, for Plukenet's description will cover no other American thorn, certainly none other that was raised in England at that time.

Plukenet's plate 46, Fig. 2, undoubtedly refers to *C. Phænopyrum* (Linn. f.). There is a good plate of this in Hort. Brit. Linnæus referred this plate to *Cratægus coccinea,* and it has long been incorrectly referred to as *C. cordata* (Miller).

Plukenet's plate 46, Fig. 4, is the first figure referred by Linnæus to *Cratægus coccinea.* This figure and description require a smooth thorn with broad, slightly-lobed leaves, and a

red, two-seeded fruit. The only known American thorn that fits this description is *C. Margaretta* Ashe (= *C. Brownii* Brit.). This was not known from the coastal plain region, but there is a specimen in the U. S. National Museum from Maryland. Fig. 5 of plate 99 is a young shoot of *Cratægus Crusgalli* L.

Plate 100, Fig. 1, was referred by Linnæus to *Cratægus tomentosa*. This is the same as *Cratægus uniflora* Muench. or *C. parvifolia* Aiton. It is a common coastal-plain species, which both Banister and Clayton must have collected in Virginia. Clayton mentions but one species with leaves hairy on the lower side, and the reference is doubtless to this species.

That Linnæus did not know well the thorns he was describing, is partially proved by his referring *C. Phænopyrum,* a five-seeded species, to a two-seeded species. Miller's descriptions of the *Cratægi* raised in England is invaluable to us in tracing out these Linnæan species. As Miller says, Linnæus was doubtless misled by Kalm.

Cratægus viridis L. was collected and probably described by Clayton. About this species there can be no question, for there is a Clayton specimen of *C. viridis* in the British Museum.

A colored plate was made by Ehret for "Plantæ Selectæ" between 1750 and 1762. This may be the first illustration of *Cratægus flava* Aiton. It certainly belongs to the *flavæ,* and was raised from seed sent from Carolina by Catesby in 1724. Another American thorn, *C. punctata,* was illustrated by Jacquin in Hort. Vind., 1770.

Further Remarks on the Botanical Exploration of the Bahamas: Dr. N. L. BRITTON.

Referring to a previous communication made to the club and to others, printed in the *Journal of the New York Botanical Garden,* Dr. Britton gave an account of the recent expeditions of Mr. L. J. K. Brace to Crooked Island, Acklin's Island, Long Cay (Fortune Island), and Andros, and of his own trip in February and March, in company with Dr. C. F. Millspaugh, to Eleuthera, Little San Salvador, Cat Island, Conception Island, Watling's Island, and Long Island. During the progress of this trip Mrs. Britton explored the northern part of Eleuthera, and did some collecting on New Providence. The greater portion of the archipelago has now been visited through the cooperation of the Field Museum of Natural History with the New York Botanical Garden, but the extreme southeastern islands, including Atwood Cay (Samana), Mariguana, and the Caicos Islands are as yet botanically unknown, and the central portion of the large island of Andros is a *terra incognita.* The small islands on the Cay Sal bank also remain unvisited. Dr. Britton exhibited specimens of many of the characteristic species and remarked on their distribution.

The club adjourned at five o'clock until October 8, 1907. C. STUART GAGER,
Secretary

NEW YORK ACADEMY OF SCIENCES—SECTION OF GEOLOGY AND MINERALOGY

AT the regular monthly meeting, May 6, 1907, the following papers were presented:

Correlation of the Newark Trap Rocks of New Jersey: Professor J. VOLNEY LEWIS.

The disconnected extrusive traps west of the Watchung Mountains may be explained in several ways, but they are probably the results of scant eruptions, the New Vernon crescent being the upturned western edge of the Long Hill trap. The extrusives at Sand Brook and New Germantown are probably outlying remnants of, or at least contemporaneous with, the flows of First and Second mountains.

Darton's dike-and-sheet hypothesis of the Palisades sill is not supported by the facts, the trap being roughly conformable to the strata, so far as known, in all directions. The chance of the fissure of intrusion coinciding with the western flank of the Palisades from Weehawken to Haverstraw is exceedingly small. On the other hand, data now available quite satisfactorily establish the connection between the Palisades and the trap of Rocky Hill to the southwest, and a section along the Delaware River shows a threefold repetition of this by faulting. Thus there is but one intrusive sheet, which gives off numerous dikes

and apophyses, in contrast with four extrusives, Second Mountain being double.

The intrusive is considered of later age than the first extrusive, and may be contemporaneous with one of the later extrusives or subsequent to all of them. This conclusion is in harmony with the results of recent studies of the copper deposits, which are intimately connected with the intrusion of the great Palisades sill.

There are many points of resemblance to the Connecticut Valley traps: the same number of extrusives appear in both, grouped in the uppermost strata; in both the second is a double flow; an intrusive sill lies near the base, and dikes cut the intervening strata.

This paper was illustrated with maps and lantern slides.

Recent Investigations of the Potable Water Supplies of New Jersey: Dr. Henry B. Kümmel, State Geologist of New Jersey. The paper was illustrated with maps.

Some Volcanoes of the Western Mediterranean: Dr. Henry S. Washington.

The speaker described briefly the volcanoes of Catalonia, Sardinia, Pantelleria and Linosa, which he visited for the Carnegie Institution in the summer of 1905. The Catalonian eruptions are referred to two phases, a first of extensive lava flows, followed by the formation of numerous small cinder cones, the material being basaltic in every case, nephelite appearing in some types. The Sardinian occurrences consist of extensive sheets of basalt and trachyte of Tertiary age, with the two later large volcanoes of Monte Ferru and Monte Arci, both of which show an interior core of salic rocks (trachytes and phonolites at the former and rhyolite at the latter), covered by extensive mantles of basalt. The last phase of vulcanicity in Sardinia is seen in a long line of small cinder cones of recent date, much resembling those of Catalonia, in both form and material. The island of Pantelleria is quite complex, but here also the earlier eruptions were of trachytes and phonolites, the activity closing with the formation of small, basaltic, cinder cones. The small islet of Linosa, which is almost unknown, shows nine volcanic cones, two phases of eruption being evident: the first producing basalt tuff cones, and the second basaltic cinder cones, similar to those from the other localities. The paper was illustrated by numerous photographs taken by the speaker.

A Contribution to the Geology of Maine: Dr. Ida H. Ogilvie. The paper was read by title.

A Peridotite Dike in Coal-measures of Southwestern Pennsylvania: Professor J. F. Kemp and Mr. J. G. Ross. This paper will be published in the *Annals* of the Academy.

Alexis A. Julien,
Secretary of Section

DISCUSSION AND CORRESPONDENCE

THE ADMINISTRATION OF THE OHIO UNIVERSITY

To the Editor of Science: A remarkable and, it is to be hoped, unique condition of affairs exists at present in the Ohio University. There is at least one spot in this "land of the free and home of the brave" where Russian administrative methods are in vogue. At a recent meeting of the board of trustees a member of the faculty was summarily dismissed. The president seems even to have willfully misled the man, for he discussed with him his work for next year only a few days before commencement. His dismissal was certainly not for incompetence. The charge against him was that he had unfavorably criticized the administration to one of his colleagues. Evidently the delator, who is the natural product of similar conditions everywhere, got in his nefarious work. One member of the board was guilty of the same conduct toward another member of the faculty, although he had always professed to be his special friend. Whether the discharged professor spoke the truth was not considered; he was condemned on ex parte evidence without being given a chance to be heard. Six years ago Alston Ellis, who had formerly been at the head of the Colorado Agricultural College, was chosen president. His career in that state was comparatively brief and would have

been briefer had he not voted for himself when he was proposed for reelection. He had hardly been installed at the Ohio University when he gave it to be understood that although there might be committees of the board and of the faculty, his fiat was final; the rest was mere matter of form. One member of the faculty, the oldest in length of service, resigned recently rather than submit any longer to being browbeaten or ignored. When committees of which he was a member were called together he was left out, because once or twice he had had the bad taste to differ with the president. Although a petition signed by about five students out of six was presented against the acceptance of the offered resignation no notice was taken of it officially. Under almost any conceivable conditions one would have supposed that the board might wish to know the cause of such an unusual step.

When names were proposed for honorary degrees the president arbitrarily rejected those of persons whom he thought unlikely to be of any service to him and added those whom he believed or assumed to be in position to requite the favor. Another specimen of the method the president has of making himself felt was the adoption of a resolution by the board—at least he says they did—*requiring* the attendance of the entire faculty at the morning chapel exercises. A request to this effect would have accomplished the same end without producing any ill feeling; but that would not have been a demonstration of his authority. As these exercises consist, for the most part, of a platitudinous speech twenty or thirty minutes long by the president, the performance is highly edifying to at least one person present. The slender attendance on the part of the student body evinces the interesting character of the exercises. For a number of years Albert Douglas, of Chilicothe, has cherished the ambition to succeed General Grosvenor as member of Congress. Being a trustee of the Ohio University, as was also one of his foremost champions, it occurred to them that here was a chance to make the higher (?) education serve some personal ends. With the active aid of the "college crowd" he was nominated by methods that reminded one of those in vogue in Central America except for the absence of fire-arms. What the voters of the district thought of the performance was shown by the ballot cast; for while that of the Democrats remained about the same the Republican vote fell off several thousand. As General Grosvenor had been elected ten times without, in any way, using the college to help him it is evidently not essential to an acceptable candidate. Now behold how things work together for good to them that love a congressman! One after another of Mr. Douglas' henchmen were placed on the college payroll. For the most unscrupulous member of the coterie a special office, that of alumni secretary, was created, although the number of living alumni outside of Athens probably does not exceed five hundred. If they had been consulted this man would not have received one vote in fifty. As neither he nor the president of the college is a graduate of the institution the transaction has a queer look, especially when we take into account the fact that the salary attached to the position is out of all proportion to the service rendered even if it were of the most efficient sort. Albeit, Mr. Douglas is an "honorable man," and declared, when accepting the nomination that he had made no promises of any kind and was under obligations to no one.

Some months ago one of the trustees was sued at law by a member of the faculty on the ground of a misappropriation of a sum of money entrusted to him several years previous for investment. After various delays, the animus of which was plainly evident to those conversant with the local situation, the suit was decided in favor of the plaintiff and the defendant ordered to return the money, including the cost of prosecution. This was done. As the man is absolutely penniless the question naturally arose, Where did the money come from? Later it transpired that a number of members of the faculty had been approached, at the instigation of the president, for a contribution, on the ground that it would be a misfortune to lose the services of

so valuable a member of the board. As he has all along been one of the most obsequious supporters of the president, having absolutely no will of his own, the grounds of his value are evident. To the credit of the faculty be it said, that most of them refused to be "grafted" for such a purpose. As the institution was founded to promote "religion, morality and knowledge" it is evident from what appears above and from much additional testimony that might be adduced that these terms are just now somewhat "liberally" interpreted.

Chas. W. Super

Athens, O.,
July 22, 1907

SPECIAL ARTICLES

IMPROVEMENTS IN THE ULTRA-VIOLET MICROSCOPE

The resolving power of a microscope varies directly as the numerical aperture of the objective and inversely as the wave-length of the light employed.[1] In other words, the shorter the wave-length the smaller the objects that can be distinguished. Light of half the usual wave-length will show details one half the size of those seen with ordinary light.

The advantage of using light of extremely short wave-length for microscopic purposes has been known for many years and was given clear expression by Czapski in 1891.[2] For some time, however, little or nothing was done to carry out Czapski's suggestions, for several reasons. First, ultra-violet light is invisible to the eye and though able to affect the photographic plate energetically, can not be focused directly even on a fluorescent screen inserted in the camera in place of ground glass, on account of the weakness and indistinctness of the image when high powers are used. Second, the glass of which ordinary objectives are made is opaque to all but the relatively long waves of ultra-violet light which lie just beyond the visible spectrum, which rays give but slightly increased resolution. So little advantage could be gained that glass objectives corrected for ultra-violet light were never made.

Early in the present century, Köhler began experimenting with lenses of quartz and fluorspar, two substances very transparent to ultra-violet light. Such lenses could be used with ultra-violet of very short wave-length which would give greatly increased resolving power.

While Köhler was in the midst of these experiments von Rohr, in 1902, made a great discovery. He invented a new system of lenses made of only a single substance, yet almost perfectly corrected for spherical aberration for light of a certain definite wave-length.

Herschkowitsch shortly before had learned how to make optically homogenous melted quartz in fragments large enough for the minute lenses of a microscopic objective. Under Köhler's energetic leadership, these discoveries were utilized at once and within two years he was able to describe a complete outfit for using ultra-violet rays in photomicrography and to publish numerous plates showing the remarkable performances of this new ultra-violet microscope.[3]

These new lenses, called monochromats, are corrected for ultra-violet light of one definite wave-length—a bright line in the spark spectrum of cadmium whose wave-length is 0.275 μ, or as more commonly written, 275 $\mu\mu$. With ordinary light composed of many wave-lengths, the images given by the monochromatic objectives are distressingly bad, blurred and fringed with rainbow colors due to chromatic aberration, for which the lenses are not at all corrected. It is out of the question to focus the object with such light, and the statement pub-

[1] This is commonly expressed by the formula $d = \lambda/2A$ where d = size of smallest detail resolved by the microscope, λ = the wave-length of the light employed, and A = the numerical aperture of the objective.

[2] Czapski, S., Die voraussichtlichen Grenzen der Leistungsfähigkeit des Mikroskops, in *Zeitschr. f. wiss. Mikroskopie*, 8: 145–155, 1891.

[3] Köhler, Aug., Mikrophotographische Untersuchungen mit ultra-violettem Licht, in *Zeitschr. f. wiss. Mikroskopie*, 21: 129–165, 273–304, Figs. 1–8, Pls. 1–6, 1904.

lished by the Zeiss firm in announcing the new outfit for sale, seemed to be only too true.[4]

The ultra-violet light of the cadmium spark being absolutely invisible (it can not even enter the human eye owing to the opacity of the lens to rays of so short a wave-length), it was necessary to devise some system for focussing the objects preparatory to photographing them. For this purpose, Köhler has used a very ingenious "seeker" which consists of a simple quartz lens and a fluorescent screen placed over the eyepiece. This screen lights up under the action of the ultra-violet rays. If the objects under the microscope be brought to a focus on this screen the image, when the seeker is removed, will be thrown to a focus on the photographic plate some 30 cm. above.

Ordinary glass being perfectly opaque for the rays from the cadmium spark, it is, of course, necessary to make of quartz not only the prisms for separating the rays used for photographing with this microscope, but also the collector and collimator lenses, the substage condenser, the slide and cover, the objective and the eyepiece. Even the ordinary glass substage mirror can not be used but must be replaced by a totally-reflecting quartz prism.

When high power monochromatic objectives are used (and these alone give resolution superior to that of a good visual objective), it is found to be tedious and difficult to get the object in focus owing to the danger of screwing the objective down too far and breaking the cover glass, if not the objective itself. When finally the object is seen, it is found to be impossible to get a sharp focus on the minute details which it is desired to photograph, because of the dimness of the image shown by the seeker. Very minute or very delicate objects, such as bacteria and small protozoa often can not be seen at all, and the observer must focus on an air bubble or some chance particle of dirt in the hope that some of the objects he seeks may lie in the same plane. Such minute, unstained living cells or the equally small constituent organs of larger cells are, however, of most interest for study with the ultra-violet microscope, not only because of the superior resolving power of the new lenses, but also because, owing to the opacity of many parts of the cell to ultra-violet light, the photographs show such living cells as if they had been fixed and stained, giving a welcome proof of the reality of the structures observed in the cells after killing and staining.

While trying to use one of the new microscopes[5] in April, 1906, on such objects, we hit upon a new and in our opinion much better method of focusing.

Instead of employing a single pair of electrode holders as planned by the makers (Fig. 1), we use a double pair of holders (four in all) arranged so that the cadmium electrodes can be instantly swung out and replaced by a pair of magnesium electrodes by means of the handles shown in Fig. 2. The cadmium electrode holders are longer than those for the magnesium for a purpose to be explained later. There is an automatic stop on the lower pair of holders to insure the spark-gap falling in the axis of the collimator lens.

We were led to devise such a swing-out electrode changer by discovering that the monochromatic lenses, through giving only badly blurred and colored images with ordinary light, *did give very good images that could be focused sharply even to the finest detail, providing strictly monochromatic visible light were used.* The spark spectrum of magnesium shows a well isolated line in the blue that proved to be very well adapted for making exploratory observations and for focusing. The wave-length of this line is 448 $\mu\mu$. It is near the line G (431 $\mu\mu$) of the solar spectrum.

In using the ultra-violet microscope by our method the object is first found and centered with a low power visual lens, using the magnesium blue light. Then the high-power

[4] "With light of considerably different wave-length, more particularly daylight, our Monochromats cannot ever be used." Carl Zeiss, Circular M. 170, Jan., 1905, p. 6.

[5] Kindly loaned by Mr. H. G. Kribs, pending the arrival of the highest power objective ordered from Germany.

monochromat is used and a detailed exploration made of the object, using the blue light all the time in a room lighted as much as desired by incandescent lamps or otherwise (the room should be darkened when the photographic exposure is made). Finally, when a particular spot is found of which a photograph is wanted, the camera is moved into place and then all is ready for the exposure except for a correction of the focus of the objective due to the change in wave-length from 448 $\mu\mu$ to 275 $\mu\mu$. This latter correction must be worked out by trial for each objective, but once determined can in future be made in a moment. The objective when used with ultra-violet light must be racked down a considerable distance below the focal point for the blue rays. This distance that the objective must be lowered is read off on the scale of the fine adjustment screw of the microscope stand. In case of our 1.7 mm. monochromatic objective the focal correction amounts to forty divisions of the fine adjustment screw of the Zeiss Photomicrographic stand (about 0.08 mm.).

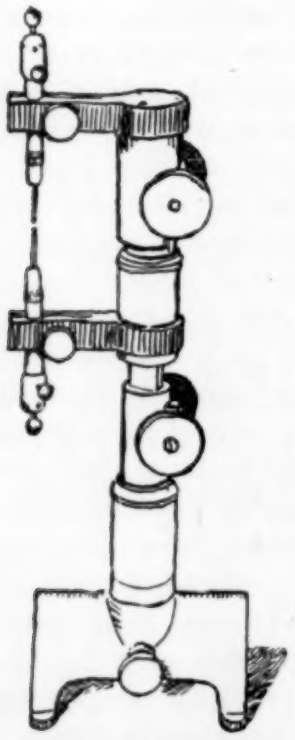

Fig. 1. Electrode holders supplied with the ultra-violet microscope by the maker. Two simple holders with screw clamps to hold the wire (or ribbon) electrodes.

By having the arms of the magnesium electrode holders 5.5 mm. shorter than those for the cadmium it was found possible to bring the blue light and the ultra-violet rays to a focus at the same distance beyond the prisms and collector lens, though not in the same spot, as the ultra-violet rays are refracted much more than the blue rays in passing through the prisms. The illuminating apparatus is made to swing laterally as a whole,

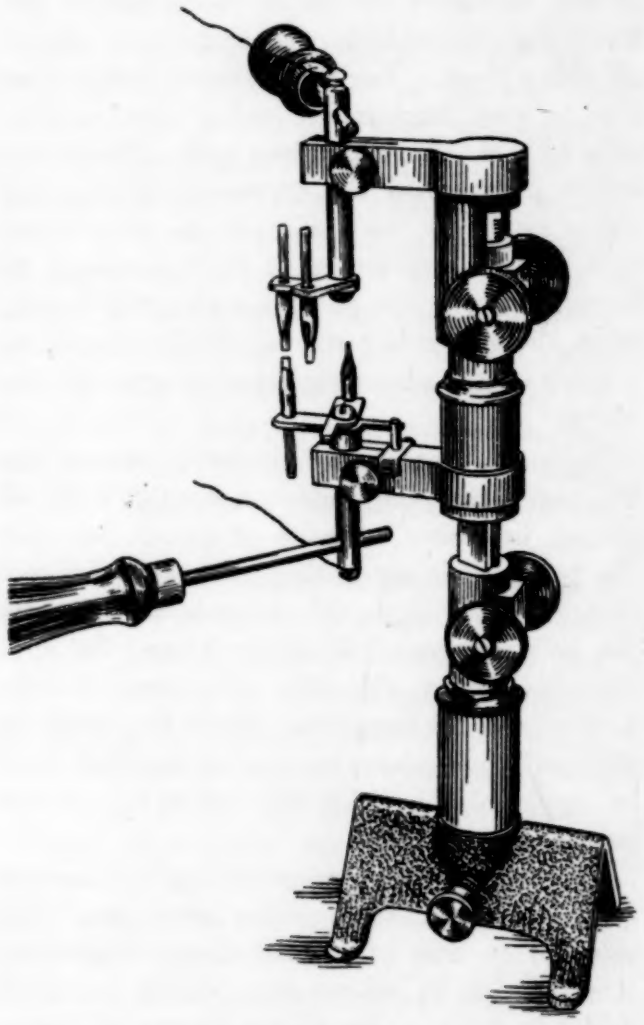

Fig. 2. New swing-out electrode holders. With two pairs of holders; the short ones for magnesium, the long for cadmium. The holders are open above so the electrodes can be removed easily for adjustment. The lower pair have a stop to bring the electrodes automatically in line. Either pair of holders may be thrown into position by turning the handles. About three tenths natural size.

so it is very easy to direct the blue or the cadmium rays upon the face of the totally reflecting prism that throws the light into the substage condenser. By using two stops along the curved way on which it swings the illuminating apparatus can be made to stop automatically at the right place to throw the blue or the ultra-violet light into the microscope.

One great advantage of this system of focusing is that in studying living cells it is possible to do all the exploratory work and to focus exactly on the details to be photographed while using blue light. Only after the adjustments are made is the ultra-violet light thrown on for the few seconds necessary to make the photograph. This prevents injuring the cells with ultra-violet light before they are photographed—an injury to which many delicate cells are very subject, as shown by the investigations of Hertel.[6]

We have made a number of other minor improvements in the ultra-violet microscope, such as a swing-out screen to protect the eye and the microscope from the light of the spark; a pair of insulated rods to hold in place the wires that conduct the high tension electricity from the coil and leyden jars. The strength and the steadiness of the spark have been improved by inserting a few inductance coils in the circuit.

None of the changes are costly and the swing-out electrode holders can be made in a day by any good mechanic for a few dollars. On the other hand, owing to the increased precision in focusing, it will no longer be necessary to buy the whole series of expensive monochromatic lenses. For most biologists, the only one that will be needed is the highest power objective of 1.7 mm. focal length, which alone exceeds the ordinary oil immersion lenses in resolving power.

Finally, it should be noted that the monochromatic blue light of the magnesium spark is very useful for making photographs of microscopic mounts on glass slides with ordinary visual objectives. In fact, no other photomicrographic outfit is so convenient for every day use in a laboratory that is provided with an electric lighting circuit.

The improvements of the ultra-violet microscope here noted were described and exhibited in April, 1907, at the Washington meeting of the National Academy of Sciences and a few days later at the Washington meeting of the American Physical Society. An illustrated account of the ultra-violet microscope and our improvements, together with a few photographs showing its utility in the study of microscopic objects, as well as concise directions for setting up and using the outfit, has been prepared and will shortly be published as a Bulletin of the Bureau of Plant Industry, U. S. Department of Agriculture.

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July 26, 1907

[6] Hertel, E., Ueber Beeinflussung des Organismus durch Licht, speziell durch die chemisch wirksamen Strahlen, in *Zeitschr. f. allgem. Physiologie*, 4: 1–43, 1904.

CONCERNING THE RELATIONSHIP OF PHYLLOSTICTA SOLITARIA TO THE FRUIT BLOTCH OF APPLES

DURING the past four years, the writer has been collecting specimens of apple leaves and fruits having spots on them caused by fungi. Recently these specimens were examined to determine what fungi are present in the spots. As a result of this examination, it was found that a fungus which caused spots on the leaves and fruits of a wild crab-apple (*Malus coronaria* (L.) Mill.) also caused spots on the petioles and underside of the midribs of the leaves and of the fruits of the common apple (*Malus Malus* (L.) Britton), a condition that might be anticipated.

The spots on the leaves of the crab-apple are either brown or white, about a millimeter in diameter, and with a distinct, raised, brown or purplish border. In the center of the spots there is a single, minute, black pycnidium (rarely more than one). The white spots may be older than the brown ones, both occurring side by side on the leaf. The spots on the

petioles and midribs of the common apple are also brown and sunken and contain one to several pycnidia, the spots occasionally coalescing.

The appearance of the fungus on the fruits of both the crab-apple and the common apple is similar and the effect is much the same. There are brown spots on the fruits, from one fourth to one half an inch in diameter, with a few to as many as fifty black pycnidia near the center of the spots, the spots often coalescing. The fungus prevents the further growth of the fruit in the infected area. The tissue becomes shrunken and firm and cracks are formed around the spots. This spotting of the common apple is the same as the disease described by Clinton[1] in 1902, under the name of "fruit-blotch (*Phyllosticta* sp.)," and, in considerable more detail, by Scott and Quaintance[2] in a bulletin recently issued by the United States Department of Agriculture.

Finding the fungus on the petioles of the common apple suggested the possibility that it might also occur on the branches. A search was at once made for it on a tree where it had previously been found on the petioles and fruits and it was found on both the yearling and older branches. It was more in evidence on the "water sprouts" and on the branches growing in partial shade than on those exposed to the direct sunlight, not only on this tree, but on others in the same orchard. The next day the fungus was found on the branches of the wild crab-apple tree where the first specimens of it were collected on the leaves and fruits.

On the twigs of last year's growth, there are light brown, flat, elliptical spots from one fourth to one half an inch in diameter, containing from a few to twenty to thirty black pycnidia. The bark is usually cracked and raised around the edge of the spot, giving it the appearance of a small canker. On the older branches the fungus grows out from the original spot and forms pycnidia around it. The formation of pycnidia outside of the point of primary infection in successive years indicates that the fungus is perennial and that it winters over on the branches. Pycnidia were developing this spring at about the same time that the apple trees were beginning to show signs of activity. After pieces of the infected twigs had been in a moist chamber a few days, small white masses of spores began to ooze out of the pycnidia. These spores germinated when seeded in a synthetic-agar culture medium and a mycelium developed. Infection of the leaves and fruit during the spring and summer is probably brought about by the spores that develop in the cankers on the branches.

The spots on the petioles, fruits, twigs and branches are much alike in size and general appearance, but they are five to ten or more times larger than the spots on the leaves of the crab-apple and the number of pycnidia in them is many times greater.

Several investigators, including those already referred to, seem to agree that the "fruit-blotch," "apple-blotch," "dry-rot," etc., is caused by a species of *Phyllosticta*, but what species is not indicated. The fungus as it occurs on the leaves of the wild crab-apple furnishes a clue for its determination. In 1895, Ellis and Everhart[3] described and named a fungus occurring on the leaves of the same host as *Phyllosticta solitaria* E. & E., which in all probability was the same as the one under consideration. Both have the "spots minute, 1 mm., round, pale white with a darker border. Perithecia epiphyllous, solitary, one in the center of each spot, 75 μ diam. Sporules sub-globose, hyaline, nucleate, 5–6 μ diam.," and, in addition, those collected by the writer have many of the spots brown and the pycnidia ("perithecia") and spores larger. There is a considerable variation in the size of the pycnidia on the same leaf and of the spores in a pycnidium. The spores found by the writer range from 5–6 $\times$ 6–9 μ, the smallest being about the

[1] Clinton, George P., "Apple Rots of Illinois," Univ. Ill. Bul. **69**: 190–191, February, 1902.

[2] Scott, W. M., and Quaintance, A. L., "Spraying for Apple Diseases and the Coddling Moth in the Ozarks," U. S. Dept. Agr. Bul. **283**: 14–18, April 29, 1907.

[3] Ellis, J. B., and Everhart, B. M., *Proc. Phil. Acad.*, 430, 1895.

same size as those of Ellis and Everhart.[4] Type specimens have not been seen by the writer. The pycnidia are somewhat larger on the fruits and branches, but the spores are about the same size as those on the crab-apple leaves. The following are the spore measurements: From the same crab-apple tree—leaves, 5–6 × 6–9 μ; fruits, 5–6 × 8–9 μ; branches, 6–7 × 9 μ. From the same common apple tree—petioles, 5–6 × 7–9 μ; fruits, 5–6 × 8–10 μ; branches, 5–7.5 × 7.5–10 μ. The largest spore measurements are mostly from fresh spores developed in the moist chamber. These spore measurements agree with those of Clinton's[5] "fruit-blotch" fungus.

From the above, it seems evident that the "fruit-blotch" disease of apples is caused by *Phyllosticta solitaria* E. & E. and that the fungus causing it may occur on either the leaves, fruits, or branches (or on one or more of them at the same time) of the wild crab-apple (*Malus coronaria* (L.) Mill.) and the common apple (*Malus Malus* (L.) Britton).

Specimens of the fungus on branches can be furnished to persons requesting them.

JOHN L. SHELDON
WEST VIRGINIA AGRICULTURAL EXPERIMENT STATION, MORGANTOWN, W. VA.,
May 25, 1907

[4] Ellis, J. B., and Everhart, B. M., *Proc. Phil. Acad.*, 430, 1895.

[5] *Loc. cit.*

HOLOTHURIAN NAMES

AN excellent memoir on "The Holothurians of the Hawaiian Islands" by Dr. Walter K. Fisher, of Stanford University, has just been published "from the Proceedings of the United States National Museum." As I had been informed that Dr. Fisher had fully subscribed to all the nomenclatural rules of the American Ornithologists' Union, I was curious to learn whether he had applied those rules to the nomenclature of the group in question. Years ago, being much interested in the echinoderms, I looked up various questions, with the result of finding unsatisfactory conditions in the naming of the group. The full history of the various episodes has not been given in the current histories by Ludwig (pp. 303–316) and others. I call attention to some here.

Dr. Fisher has referred to "*Holothuria* LINNÆUS, Systema Naturæ, 10th ed., 1758," as the source for that name. Evidently he had not consulted the volume cited, for there is no mention in it of any animal now called *Holothuria*.

In the tenth edition (I., p. 657) Linnæus defined his genus "260. HOLOTHURIA" as follows: "*Corpus* gibbum, nudum, ovale, natans. *Tentacula* sæpius ad alteram extremitatem, inæqualia numero et figura." He referred to it four species, (1) *physalis*, a Physaliid or "Portuguese man-of-war," and three other animals having no resemblance to holothurians. Unquestionably, the type of the genus and description was the first species.

In the twelfth edition (I., p. 1089) Linnæus modified his definition and, while including the four species of the tenth, added five species, (1) *frondosa* (*Cucumaria*), (2) *Phantapus* (*Psolus*), (3) *tremula* (*Holothuria* of moderns), (8) *pentactes* (*Cucumaria*) and (9) *priapus* (a worm). This is the starting point of the ordinary holothurian history.

One naturalist who was aware of these facts would not modify the nomenclature to correspond. It remains to be seen whether Dr. Walter Fisher or Dr. Hubert L. Clark will. The case is clear. If the tenth edition of the Systema is accepted as the starting-point, certainly *Holothuria can not* be retained with its modern limits, since the original was unaccompanied by reference to a single representative and the diagnosis is inapplicable. One of the synonyms of the modern genus must then replace *Holothuria*. *Fistularia*, the oldest, can not be used, as it was preoccupied. There are many later names, more or less applicable, but which one shall be used will depend on the limits given to the genus. If we accept it with the extent given by Ludwig, *Bohadschia* of Jäger (1833) may be taken. If it is limited by the exclusion of the group so named, *Trepang* (Jäger, 1833), *Sporadipus* (Brandt, 1835), *Thelenota* (Brandt, 1835) and several others are available, according to circumstances.

It may be added that *Actinopyga* should not be used for the genus first named *Mülleria* by Jäger, as Brandt had long before published a

subgeneric name (*Microthele*) which is applicable.

While on the subject remarks on several family names may be in order. Of late years almost all echinodermists have adopted the quasi-descriptive names given by Brandt (Aspidochirotæ and Dendrochirotæ) instead of Holothuriidæ and Cucumariidæ. The last, however, have been adopted by Dr. Fisher and are in accordance with the custom prevalent among modern zoologists. Both names were attributed to Ludwig (1894), but Holothuridæ was used by Gray as early as 1842 and 1848. Gray also used Cuvieriadæ and Pentactidæ, but, as they were based on obsolete synonyms, they are synonyms of Cucumariidæ. *Holothuria* being discarded, of course *Holothuriidæ* can not be used but may be replaced by *Bohadschiidæ*, based on the earliest generic name.

Theo. Gill

CURRENT NOTES ON METEOROLOGY AND CLIMATOLOGY

MONTHLY WEATHER REVIEW

In Nos. 3 and 4 of the *Monthly Weather Review* (1907) the following articles appeared: "Rainfall and Run-off of the Catskill Mountain Region," by Thaddeus Merriman; a report to the Board of Water Supply of the City of New York, illustrated by a map of the Catskill Mountains and vicinity, showing by isohyetal lines the probable mean annual rainfall; also by cross-sections, showing rainfall values along different critical lines.

"Variation of Precipitation in the Adirondack Region," by Professor A. J. Henry; comments upon a paper by R. E. Horton, in the January *Monthly Weather Review*, pointing out that Mr. Horton's rainfall amounts for the lustrum 1901–5 are not to be taken as average or normal values, this five-year period having been one of heavy precipitation.

"The Temperature in the Front and in the Rear of Anticyclones up to an Altitude of 12 Kilometers, compared with the Temperature in the Central Area," by H. H. Clayton. This summarizes results obtained by means of *ballons-sondes* from St. Louis. Up to about 8 kilometers the temperature was lower in front and higher in the rear than in the central area; between 8 and 10 kilometers the central area was colder than front or rear; and above 10 kilometers the lowest temperature was in the rear of the anticyclone and the highest in front. Mr. Clayton suggests that the cold air in the northern part of the anticyclone is moving faster than the anticyclone towards the southeast and sinks towards the earth's surface on account of its greater specific weight as compared with the surrounding air. The center of the anticyclone is about midway between the northwest and southeast limits of the inclined stratum of cold air. The circulation of air around a central area is confined to a stratum within about 2 kilometers of the earth's surface. The movement of the air at different heights in cyclones and anticyclones is shown by means of diagrams.

"Cooling by Expansion and Warming by Compression," by Professor C. E. Peet, and "Espy's Nepheloscope," by Professor Cleveland Abbe, describe simple apparatus for use in condensation experiments in school meteorological teaching.

"Bells as Barometers," by Professor Cleveland Abbe; note on some erroneous statements which have been going the rounds of the press regarding the so-called "water-bells" near Lebekke, in Belgium.

"A Proposed New Method of Weather Forecasting by an Analysis of Atmospheric Conditions into Waves of Different Lengths." This is a paper of unusual importance by H. H. Clayton which presents, in brief outline, the results of studies extending over many years in connection with long-range forecasting. The author believes that "the discovery of these facts not merely opens the way to a great improvement in the forecasting of weather from day to day, but also . . . furnishes a scientific basis for long-range forecasting." This paper is well illustrated, and merits careful study.

"The Velocity of Centers of High and Low Pressure in the United States," by C. F. von Herrmann; a determination of these velocities for the period 1878–1904, and a comparison with Loomis's results for 1872–84. Substantial agreement is found. The average annual

velocity from the Weather Bureau records is slightly higher than the earlier averages. The minimum is found in June (24.0 miles an hour) instead of August (22.6 miles). The highs show a mean annual of 25.6 miles; a maximum of 29.5 in January and a minimum of 22.1 in August.

"The 'Southwest' or 'Wet' Chinook," by H. Buckingham; "The 'Dry' Chinook in British Columbia," by R. T. Grassham; and "The Wet and Dry Chinooks," by Professor Cleveland Abbe.

COAST METEOROLOGICAL STATIONS OF CHILE

THE seventh volume of the "Anuario del Servicio Meteorolojico de la Direccion del Territorio Maritimo" of Chile (1905) contains the valuable observations made at sixteen stations along the coast of Chile. In this volume there are given for the first time the records from the port of Punta Arenas, in the Strait of Magellan. The list of stations is an interesting one and includes the island of Juan Fernandez and Punta Dungeness, the latter at the eastern end of the Strait. The southernmost stations, especially Islote de los Evangelistas, Punta Arenas and Punta Dungeness, furnish valuable data which, with those now being recorded by the Argentine Meteorological Service at its far southern stations, will soon fill up one of the gaps in the meteorological charts of the world.

UPPER AIR CURRENTS OVER THE POLAR SEA

THE *Beiträge zur Physik der freien Atmosphäre*, Vol. 2, No. 3, contains a brief report by Dr. H. Hergesell of his observations by means of balloons, undertaken during the past summer in the Arctic Ocean on board the *Princess Alice*, with the assistance of the Prince of Monaco. As to wind direction, the meteorological element concerning which there is probably the most interest, it is stated that the direction was variable (July 13–September 8), so that no prevailing direction could be established. The air moved out from the pole as often as it moved poleward. As the observed currents undoubtedly belonged to the great circumpolar whirl, it is probable that the latter must frequently have changed its position within the polar basin.

HUMIDITY CHARTS OF THE UNITED STATES

THE first complete series of monthly relative humidity charts for the United States appears in the *Report of the South African Association for the Advancement of Science* for 1906. These charts, based on data for the uniform period of fourteen years (1888–1901), published in the *Report of the Chief of the Weather Bureau* for 1901–02, p. 318, were drawn by Kenneth Johnson, of Harvard University. The lines are drawn for differences of 10 per cent. Relative humidity charts for January, July and the year had already been published, but the present series is complete for all the months, and is therefore a distinct contribution to the climatology of the United States.

CHANGE OF CLIMATE IN DAMARALAND?

IN a recent number of *Nature* (Vol. 75, 1907, 536–537), Professor H. H. W. Pearson considers the coniferous plant *Welwitschia*, discovered by Welwitsch in Damaraland. The apparent failure of natural reproduction of this plant in a region well suited to the adult plants suggests to Professor Pearson that the climate is becoming drier, and the conditions necessary to start germination are less frequent than formerly. The species is evidently losing ground, a fact which suggests climatic change.

SNOW GARLANDS

IN *Das Wetter* for June, 1907, there are published two views of a very rare phenomenon known in Germany as "Schneegirlanden." These were observed by Dr. C. Kassner, in Berlin, on January 31, 1907. The photographs were taken by him. The first description of snow-garlands was given by Hellmann in the *Met. Zeitschr.* for March, 1889, and the second was given by Assmann, in the June, 1889, number of the same journal. The curious development of these garlands, as reported by Kassner, resulted from the melting of snow on the roof of a building, and a subsequent sliding of the snow down the slope

of the roof. Finally a rounded, rope-like roll of snow hung pendant from the edge of the roof, in the shape of a very flat U, the ends remaining fast on the edge of the roof.

NOTE

"The Progress of Science as illustrated by the Development of Meteorology" is the subject of Professor Cleveland Abbe's Presidential Address before the Philosophical Society of Washington, read December 8, 1906, and published in the *Bulletin* of the Society, Vol. XV., pp. 27–56, 1907.

R. DeC. Ward

SCIENTIFIC NOTES AND NEWS

Dr. Rollin Thomas Chamberlin and Dr. Stephen Reid Capps, who received the degree of doctor of philosophy at the summer convocation of the University of Chicago, have been given appointments in the U. S. Geological Survey.

It is announced that Commander R. E. Peary is about to leave New York for the Arctic regions on the *Roosevelt*.

Lieutenant E. H. Schackelton sailed from London on July 30 on the *Endurance* for the Antarctic regions.

Dr. John B. Watson, of the department of psychology at Chicago University, has been spending some time at the Station for Marine Biology of the Carnegie Institution at Dry Tortugas, where he has been studying the habits of the sea-gulls.

Professor F. S. Earle, formerly in charge of the mycological collections at the New York Botanical Garden and later director of the Cuban Agricultural Experiment Station, has spent several weeks at the garden, continuing his investigations of the gill-fungi.

In the issue of Science for July 26 it was stated that Dr. Charles A. White is now the oldest living geologist in North America. Our attention has been called to the fact that Dr. Martin H. Boyé, of Coopersberg, Pa., though best known as a chemist, was from 1838 to 1843 assistant geologist, as well as chemist, to the Pennsylvania Geological Survey. Dr. Boyé was born at Copenhagen on December 6, 1812. He and Dr. Wolcott Gibbs are the only surviving founders of the American Association for the Advancement of Science, and Dr. Boyé is the only surviving founder of the Association of American Geologists and Naturalists which developed into the association. Lawrence C. Johnson, of Patchuta, Miss., though primarily an attorney and counsellor at law, has also made valuable contributions to geology and was publishing as recently as last year. Mr. Johnson was born at Chester, S. C., on August 18, 1822.

President G. Stanley Hall, Ph.D., LL.D., of Clark University, was announced to give at the summer session of the University of Chicago a series of five lectures on the following subjects: "The Pedagogy of History," "Moral and Religious Education," "The Ideals and Methods of Teaching," "The Claims of Modern versus Ancient Languages," and "The Feelings."

Dr. Lewellys F. Barker, professor of medicine in Johns Hopkins University and formerly head of the department of anatomy in the University of Chicago, gave the doctorate address at the eighty-fifth commencement of Rush Medical College, held in Chicago, on July 12, on "The Psychic Side of Medicine."

Professor Willis Grant Johnson, associate editor of the *American Agriculturist*, has been appointed trustee of the New York State Agricultural Experiment Station at Geneva to succeed Milo H. Owen, deceased. Professor Johnson is a graduate of the Ohio State University and of Cornell University and has been a close student of entomology and allied agricultural branches while instructor at Stanford University and at the University of Illinois. He was for some years entomologist of the Maryland State Agricultural Experiment Station.

Dr. Egon von Oppolzer, associate professor of astronomy at Innsbruck, has died at the age of thirty-seven years.

There will be a civil service examination, on September 4 and 5, to fill existing vacancies in the position of hydrographic surveyor

in the navy department at salaries ranging from $1,200 to $2,200 a year. On September 9, there will be an examination to fill vacancies in the position in the Department of Agriculture of assistant crop technologist, at salaries ranging from $1,500 to $2,000 per annum, and of crop technologist, at salaries ranging from $2,000 to $3,000 per annum, depending upon the training and experience shown.

THE Minnesota legislature has voted $5,000 a year towards the maintenance of a Pasteur Institute at Minneapolis.

THE members of the Liverpool University archeological expedition which left Liverpool at the end of April have reached Aleppo, from the mountains of Arabistan and are returning to England. Interesting discoveries are reported.

THE first Congress of Stomatology will be held in Paris from August 1 to 5, under the presidency of Dr. Galippe, of Paris, and Dr. Revier, of Lille. Practitioners of all nationalities will be allowed to take part in the proceedings.

DURING the first three weeks of July, Mr. S. P. Fergusson conducted a third expedition to Mount Washington, N. H., for the purpose of comparing the meteorological conditions on the summit with those of the free air, employing kites to lift the meteorographs. Continuous records of atmospheric pressure, temperature, humidity and the velocity of the wind have been maintained on the summit (1,916 meters) and at Twin Mountain (426 meters) during a part of each summer in 1905, 1906 and 1907. In cooperation with Professor Rotch, who assumed the cost of the additional experiments, the same instrumental equipment was employed by Mr. Clayton in obtaining kite-flights near Mt. Washington at the time of the international observations on July 22 to 27 inclusive.

MARY W. WHITNEY, professor of astronomy at Vassar College and president of the Nantucket Maria Mitchell Association, has been for a week at the Maria Mitchell Memorial on Nantucket, giving instructive talks to members and their guests on "Maria Mitchell" and on "Recent Discoveries in the Solar System." Professor Whitney has appointed a building committee to consider plans for an observatory to house properly an equatorial telescope recently donated to the association. Already the sum of $2,138 has been subscribed and the association in charge of the memorial hopes for subscriptions to enable them not only to house the telescope but also to equip the observatory so that it may be available for astronomical classes in the near future.

REUTER'S AGENCY is informed that news has been received at the Scottish Oceanographical Laboratory of the arrival of the Scottish Arctic expedition on board the steamship *Phœnix* at Prince Charles Foreland. Very heavy weather was encountered after leaving the Norwegian coast, and a large quantity of ice exceptionally far to the south and west of Bear Island. This ice continued to Spitzbergen. When Dr. William S. Bruce and his companions arrived at Prince Charles Foreland on June 11 they found the country completely covered with snow. The expedition experienced considerable difficulty in landing the scientific instruments, equipment and stores on account of a perpendicular wall of ice, which fringed the coast. Captain Hjalmar Johansen joins the expedition this month.

WE learn from *Nature* that a long excursion, extending from August 15 to August 24, has been arranged by the Geologists' Association. The district selected is Appleby and its surroundings, and the party will be under the direction of Dr. J. E. Marr, F.R.S. Interesting observational work has been allocated for each day, and the arrangements which have been made for visitors will ensure comfort at a moderate expense. The party will leave Euston at 11:30 A.M. on August 14, and geologists who wish to avail themselves of the opportunity offered should communicate with Mr. A. C. Young, 17 Vicar's Hill, Lewisham, S.E. The association has arranged an excursion also in connection with the centenary celebrations of the Geological Society in September next. The excursion will be to Reading on September 28, and will be conducted by

Messrs. H. W. Monckton, O. A. Shrubsole and H. J. Osborne White.

The British Meteorological Office has sent out a circular to the effect that the International Aeronautical Commission, which met at Milan last autumn, decided to obtain from as many stations as possible in the northern hemisphere simultaneous records of the conditions of wind, temperature and humidity prevailing in the upper air during the last week of this month. Most of the continental governments are taking part in this work, and some are sending out special vessels for the purpose of obtaining records from over the sea. England is to be represented by four land stations, one near Portsmouth, one near Manchester, one in Herefordshire and one in Scotland. The plan is to send up small balloons with very light self-recording instruments hanging from them. Often the balloons attain a height of ten or more miles before falling to the ground. A label is attached to the instruments offering a reward and giving instructions to the finder. It is hoped that any person finding one of these instruments will communicate with the address given, and so help to carry out the object of the inquiry. Many meteorologists hope that information may be obtained, which will in time lead to more certainty in the forecasting of the weather.

The first meeting of the International Association of Medical Museums was held at the Army Medical Museum, Washington, D. C., on May 6. According to the *Journal of the American Medical Association*, the committee on organization was empowered to frame a constitution and by-laws and to submit it to the active members. The following officers were elected: President, Major Carroll, Army Medical Museum, Washington, D. C.; vice-presidents, Professor W. G. MacCallum, Johns Hopkins Medical School, Baltimore; Professor J. Ritchie, Oxford University, England; and Professor J. Ludwig Aschoff, University of Freiburg, Germany; secretary-treasurer, Dr. M. E. Abbott, McGill Medical Museum, Montreal, Canada. A bulletin of museum information will be issued to facilitate exchange of specimens. The next meeting is to be held in connection with the Congress of Tuberculosis in Washington, D. C., in October, 1908. The first bulletin of the association contains an introductory statement of the purposes of the association, a full account of the meeting, a list of the organizing members, and an appeal for specimens for the medical museum of McGill University which suffered very serious loss by fire.

The International Council for the Investigation of the Sea met in London for the first time by invitation of the British Government during the week beginning June 10. The *Geographical Journal* states that on the evening of that date they were entertained to dinner by the Royal Geographical Society and the Geographical Club, when about thirty members of the council were present. After dinner a meeting of the society was held, when Dr. Otto Pettersson, acting president of the council, gave a lecture on Oceanic Circulation; after that several representative members of the council gave some account of the varied work which it has been carrying on during the past five years. During the rest of the week the council held its official meetings, and were entertained by the minister of agriculture, the secretary for Scotland, the lord mayor, and the Fishmongers' Company; they were also received at Buckingham Palace by King Edward, and many of them were present at the annual conversazione of the society at the Natural History Museum, at South Kensington.

The British Medical Journal says: Dr. Cabanès, editor of the *Chronique Médicale*, has recently founded a medico-historical society in France. Its object is not the study of the history of medicine, but the study of medicine in relation to general history, literature and art. Dr. Cabanès himself, Galippe, Brachet, Littré and others have shown what light may be thrown on obscure problems of history by a study of the physical constitution and illnesses of rulers. Similar studies have been made of Maupassant, Zola, Flaubert, Alfred de Musset and other writers and poets, and have done much to elucidate their

intellectual outlook and to supply the physical grounds for their criticism of life. The committee of the new society includes the names of Drs. Brissaud, Debove, Fournier, Gilbert, Galippe, Grasset, Huchard, Lacassagne Landouzy, Lannelongue, Pinard, Poncet, Pozzi Régis, Charles Richet, and Albert Robin as representatives of medicine, and those of such men as Anatole France, Jules Lemaitre, Victorien Sardou, and Jules Clarétie among representatives of literature. Altogether there are forty members of the Committee of Direction and Patronage, all members of the Institute of France, the Academy of Medicine, or connected with the Collége de France or the University. It begins its existence under the happiest auspices, and we shall look forward with the keenest interest to the results of work in which the most advanced science is combined with all that is best in literature and art.

THE London *Times* states that the president of the Liverpool School of Tropical Medicine, Sir Alfred Jones, has received the following telegram from the sleeping sickness expedition of the school, which was sent to Africa early in May last: "Send quantity atoxyl immediately. Cattle experiments indicate success. Montgomery Trypanosomiasis Expedition, Broken Hill, N. W. Rhodesia." Atoxyl is the name of the remedy recommended for therapeutical treatment in cases of sleeping sickness. The sleeping sickness expedition arrived at Kalomo on June 10, where they were the guests of Mr. Codrington, the administrator, who gave every facility for their work. At the end of July it was intended that Dr. Kinghorn, one of the members of the expedition, should proceed direct to Fort Jameson. Mr. Montgomery, the other member, will go west to the River Kafue, and up that river towards the Congo. He will then strike across the country, and meet Dr. Kinghorn on the river Luapala about November, traversing the whole of the time a territory infested by the T'se T'se fly. One of the main objects of the expedition, which is financed by the Liverpool School and supported by the British protectorates concerned and the British South African Company, is to endeavor to prevent the spread of sleeping sickness into districts hitherto uninfested. The expedition will also study the disease on the spot, and will pay special attention to the disease of animals and the distribution of biting flies. It is the fourth expedition of the Liverpool School that has been sent to Africa to study trypanosomiasis.

UNIVERSITY AND EDUCATIONAL NEWS

AT the summer convocation of the University of Chicago President Judson stated that Mr. Rockefeller had given during the present year about $3,000,000 for endowment and for other purposes and land on the south side of the Midway valued at $2,000,000. These great gifts have already been reported, but should be repeated now that they have official confirmation. The statement made by the daily papers, but not printed in SCIENCE, that Mr. Rockefeller had endowed a pension system in the University of Chicago is not confirmed. The land devoted to the University of Chicago is now a little more than a hundred acres. The gift of Mr. Rockefeller enabled the university to make advances in the salaries of more than eighty members of the faculty.

A COLLEGE of Education has recently been organized at Ohio State University with the object of preparing educators above the rank of grade teachers and stimulating study and research along educational lines. W. W. Boyd, formerly high school visitor, has been appointed dean and Geo. D. Hubbard, of the department of geology elected secretary. The bulletin of the college, issued in July of this year, announces courses in subject matter in all lines of the College of Arts, Philosophy and Science, in Manual Training and Domestic Science, courses in education, and courses in the teaching of the various subjects. Students may register in September, '07.

DR. LUDWIG MOND has subscribed $15,000 and Dr. Aders Plimmer $10,000 for a building for the department of physiology, University College, London. This will be erected in the south quadrangle, hitherto the playground of

the boys' school, and will constitute the first instalment of a building for the accommodation of anatomy, pharmacology, and physiology.

Arthur Crathorne, Ph.D. (Göttingen) and R. L. Börger, Ph.D. (Chicago), have been appointed instructors in mathematics at the University of Illinois. Dr. Crathorne was formerly instructor in the University of Wisconsin, and Dr. Börger has been professor of mathematics in the University of Florida.

G. D. Birkhoff, A.B. (Harvard), Ph.D. (Chicago), has been appointed instructor in mathematics in the University of Wisconsin.

Among recent appointments at the University of Chicago are the following: Charles Scofield Blair, to a research assistantship in geology; J. Claude Jones, to a research assistantship in geology; Arthur Carleton Trowbridge, to a laboratory assistantship in geology; Frank Adolph St. Sure, to an assistantship in anatomy; Stephen Walter Ransom, to an assistantship in experimental therapeutics, department of physiology; Hermann Irving Schlesinger, to an associateship in chemistry; Otis William Caldwell, to an associate professorship in botany and supervisorship of nature study in the School of Education. Promotions have been made as follows: Storrs Barrows Barrett, associate in astronomy, to an instructorship; Philip Fox, associate in astrophysics, to an instructorship; Robert James Wallace, associate in photophysics in the department of astronomy, to an instructorship.

In response to an urgent request from the large Bohemian population of Nebraska provision has been made for the teaching of the Bohemian language in the University of Nebraska, by the appointment of Mr. Jeffrey D. Hrbek, of Cedar Rapids, Iowa, to be instructor in German and Slavonic. Mr. Hrbek is a native of Bohemia, who has fitted himself for teaching in American schools by completing one of the regular courses of study in the Iowa State University. For the present his work is to be under the supervision of the professor of Germanic languages, until it develops sufficiently to warrant giving it a department by itself.

Dr. E. W. Brown, Ph.D. (Yale), has been appointed first assistant in the laboratory for animal physiology, Bureau of Chemistry, U. S. Department of Agriculture.

Mr. Adam Sedgwick, F.R.S., fellow of Trinity College, Cambridge, has been elected professor of zoology and comparative anatomy at Cambridge, in succession to the late Professor Newton. The London *Times* says: Mr. Sedgwick was educated at Marlborough and Trinity College. On the death of the late Professor F. M. Balfour in 1882, Mr. Sedgwick took over the direction of the Morphological Laboratory, and during the last twenty-five years the Cambridge Zoological School has owed much to his energy and his powers as a teacher. Mr. Sedgwick has published numerous scientific memoirs, amongst the most notable of which are those dealing with the development of Peripatus. He is also the author of an exhaustive text-book of zoology, one volume of which has still to appear. For the last ten years he has been tutor of Trinity College.

At the University of Leeds the council has appointed Dr. Walter Garstang to the professorship of zoology, and Mr. V. H. Blackman to the professorship of botany. The two chairs are to take the place of the professorship of biology hitherto held by Professor Miall. Professor Garstang, M.A., D.Sc. (Oxford), is at present chief naturalist to the Marine Biological Association and is in charge of their Lowestoft Laboratory.

At Corpus Christi College, Cambridge, Mr. Herbert Charles Resker, B.A., has been elected to the Hewett research scholarship for natural science.

Dr. Graham Steell has been appointed professor of medicine at the University of Manchester.

Professor W. His, a son of the eminent anatomist, has been appointed to succeed Professor von Leyden in the chair of special pathology and therapeutics in the University of Berlin.